

Impact of emissions from coal-fired power plants on health in India

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Motivation:

The demand for coal in India is projected to rise from 563 mtce in 2017 to 708 mtce in 2023, whereas the global demand for coal has been stabilized largely due to falling demand in North America and western Europe. The chief driver of this demand is a growing desire for coal-fired (or thermal) power plant (TPP), fueled by ongoing infrastructure development and the expansion of the country's middle class (IEA, 2018). Combustion of fossil fuels releases mercury, nitrogen oxides, sulfur dioxide and other substances known to be hazardous to human health.

Methods:

Emissions: IND-15-2013 is an anthropogenic emissions inventory developed and maintained for India by Prof. Venkataraman at IIT Bombay. Classified into two scenarios:

- All sectors
- All sectors except (coal) (No-TPP)

Difference in the 'All sectors' and 'No-TPP' scenario is attributed to Thermal power (coal).

Meteorology: GEOS-FP

Model: GEOS-Chem on AWS

Resolution: 2x2.5degrees

Objectives:

- To compare the IND-15-2013 emissions inventory for all source categories and without TPP and urban vs rural.
- To simulate air quality on GEOS-Chem on AWS under "clean energy" scenario where emissions from TPP are reduced.
- To evaluate the impacts of coal pollution on mortality and morbidity following the Global Burden of Disease 2015.

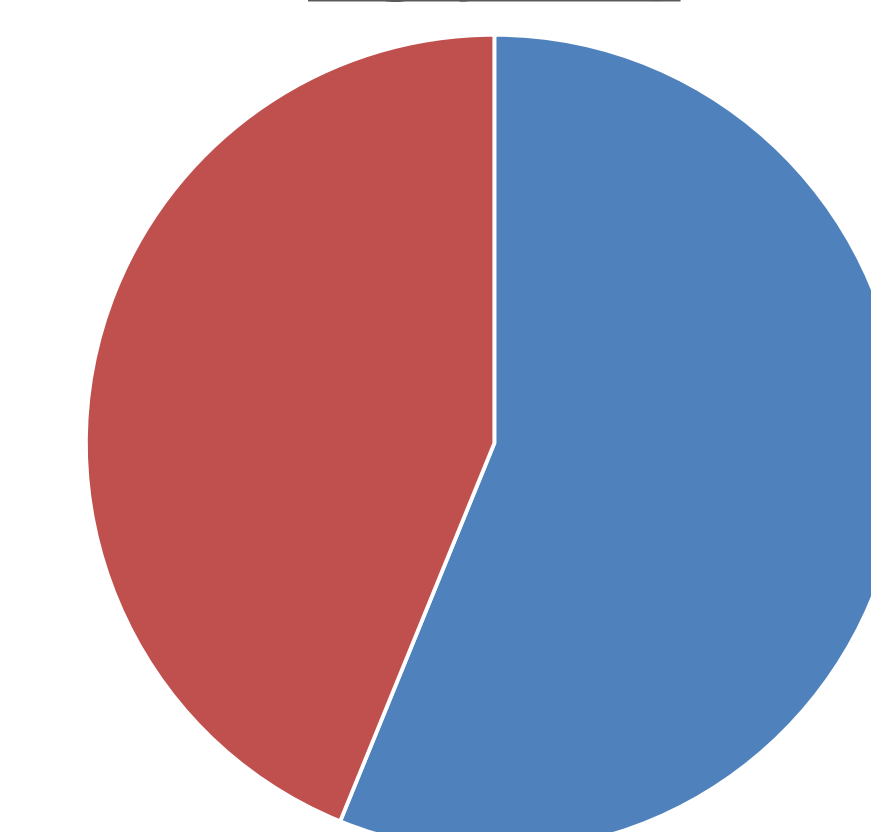
Power plants with a capacity over 600 MW



| Total Coal Consumption | Total CO2 Emissions |
|------------------------|---------------------|
| 632.14 | 1807.92 |

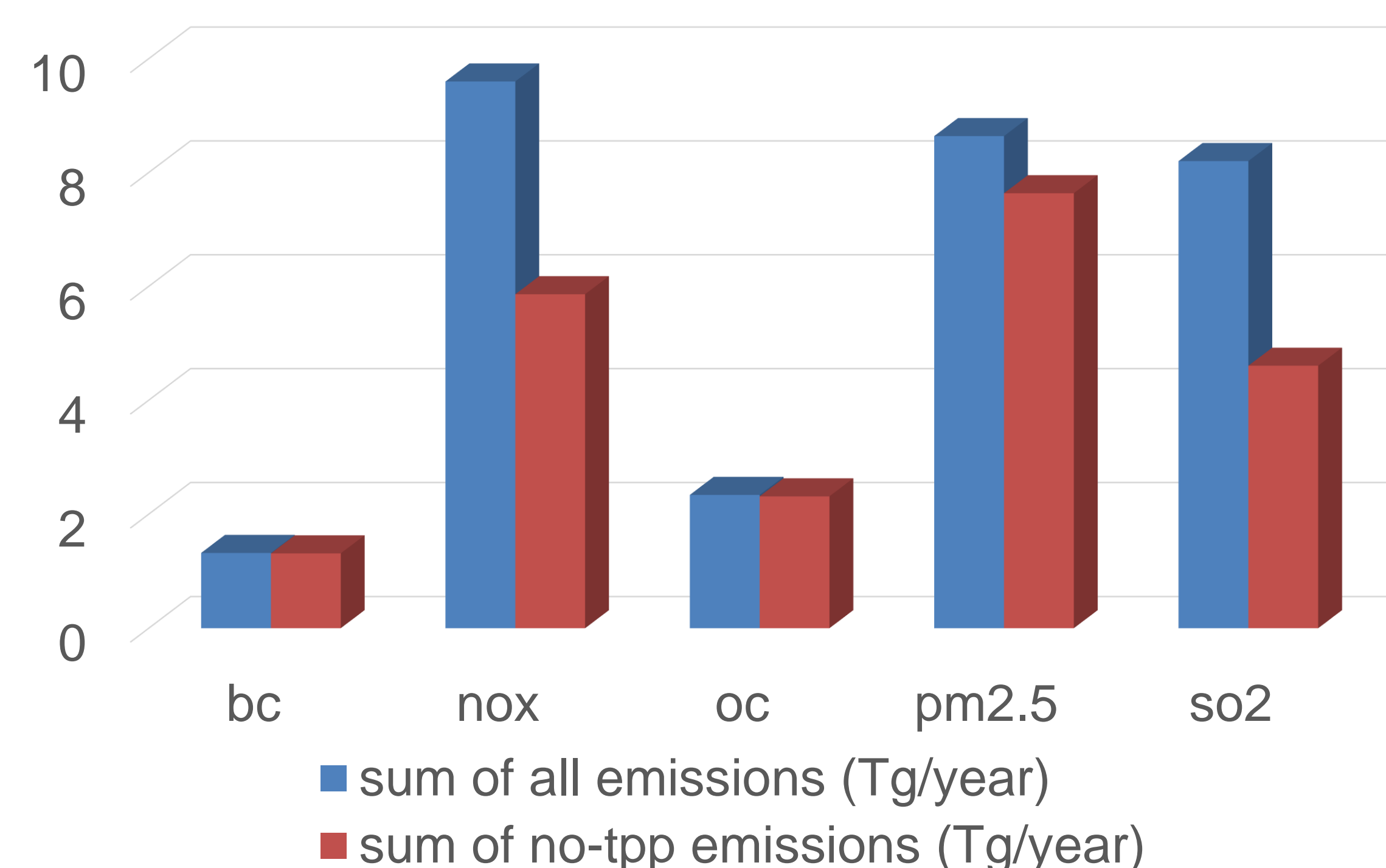
Complete combustion of 1 short ton (2,000 pounds) of coal will generate about 5,720 pounds (2.86 short tons) of CO₂

SO₂ emissions in 2013 (in Tg/year)

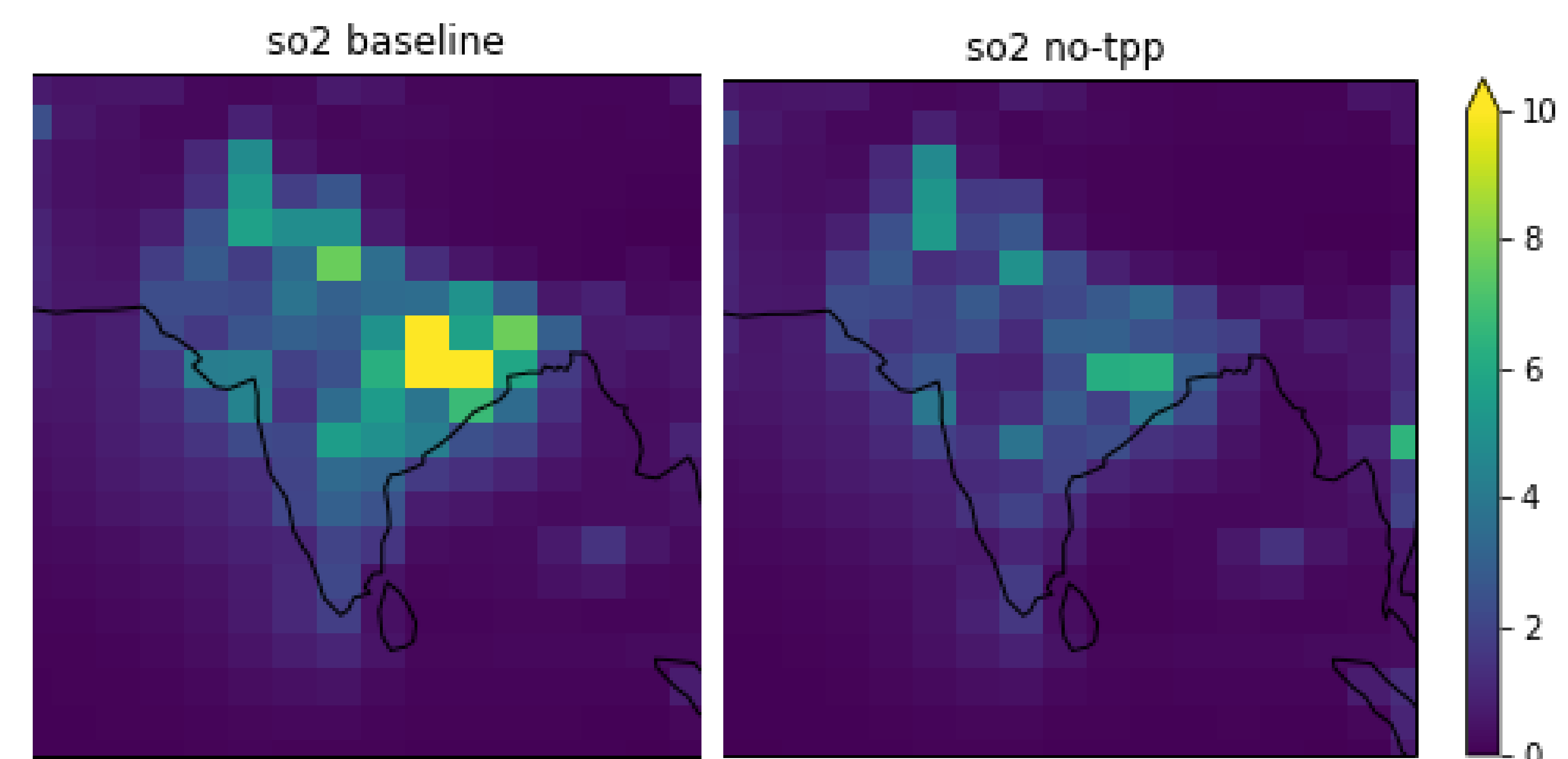
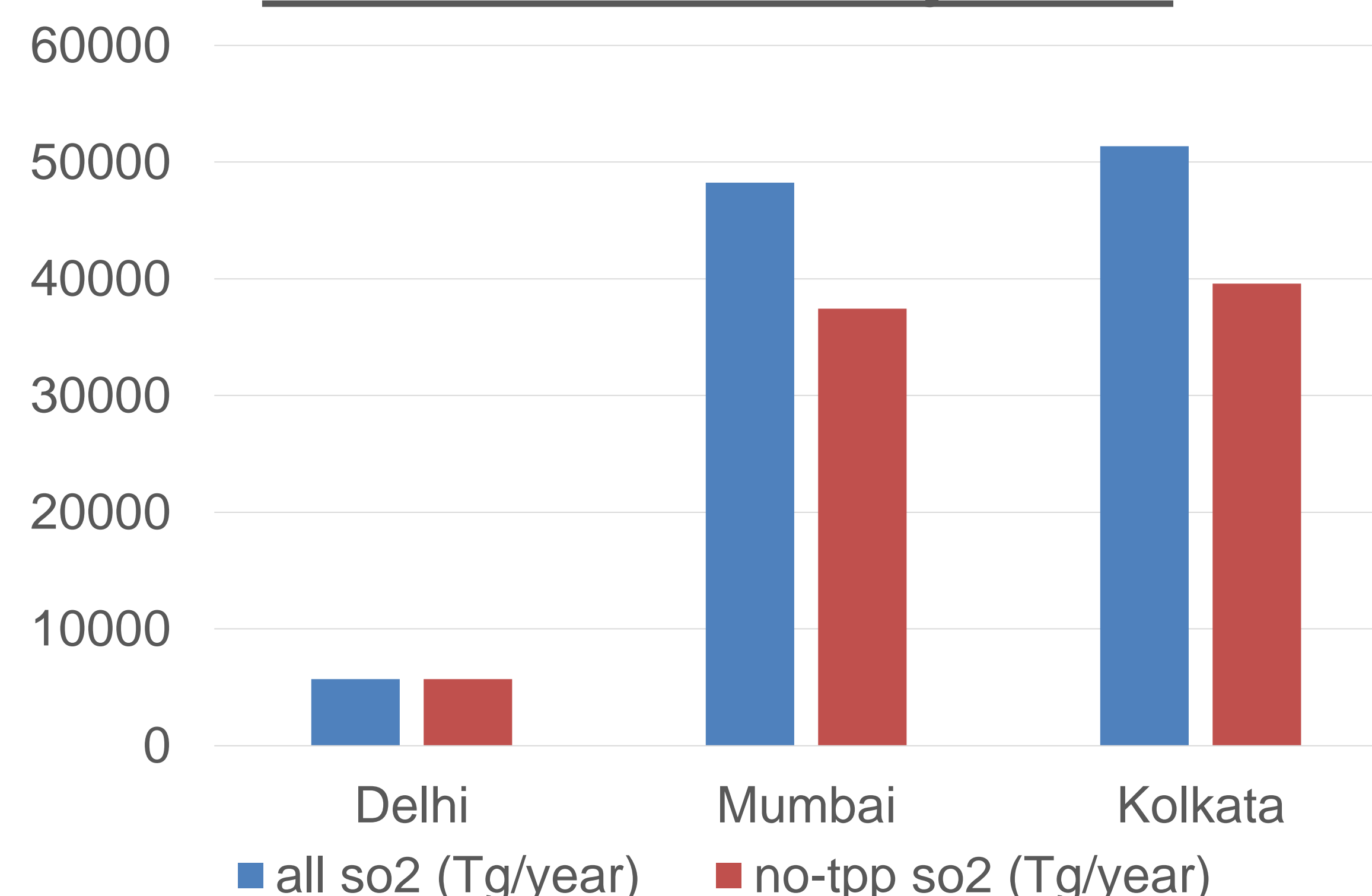


■ Total SO₂ No-TPP ■ Total SO₂ TPP

Comparing the IND-15-2013 emission inventory for all source categories and without TPP



SO₂ emissions in 3 major cities



January 2015 Monthly Average

In our preliminary GEOS-Chem output, we see dramatic decreases in SO₂ concentrations when removing TPP emissions.

Next Steps:

1. The GEOS-Chem simulation is running for the 'All sectors' and 'No-TPP' scenarios for 2015 after the spin-up phase. Once complete, we will estimate the health burden following the GBD study and model the 'All sectors' and no-coal sensitivity study.
2. Case study of specific grid cells with large power plants and those without.
3. Submit the final report to Shakti Sustainable Energy Foundation

References:

Venkataraman, C., Brauer, M., Sadavarte, P., Ma, Q., Cohen, A., Chaliyakunnel, S., et al. (2018). Source influence on emission pathways and ambient PM_{2.5} pollution over India (2015–2050). *Atmospheric Chemistry and Physics*, 18(11), 8017–8039. <https://doi.org/10.5194/acp-18-8017-2018>

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Carbon Brief <https://www.carbonbrief.org/iea-china-and-india-to-fuel-further-rise-in-global-coal-demand-in-2018>